

**(DRAFT Revised 16 April 2010; available from: <http://icoads.noaa.gov/reclaim/>)**

## **ICOADS Marine Data Rescue: Status and Future CDMP Priorities**

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### **1. Introduction**

Completion of another full International Comprehensive Ocean-Atmosphere Data Set (ICOADS) update following Release 2.5 (R2.5; spanning ~1662-2007; Woodruff et al. 2010) would be highly desirable by approximately mid 2012 to support reanalysis efforts including the NOAA-CIRES Surface Input Reanalysis for Climate Applications (SIRCA; 1840s-present), and ECMWF's ERA-CLIM (1900-present). Another reanalysis, planned by the Climate Prediction Center of NOAA/NCEP for the "radiosonde era" (~1950-present), may be starting too early to fit this schedule.

Additionally, efforts to improve sea surface temperature (SST) analyses—including by the UK Met Office of a revised HadISST product (~1850-present) and by NCDC of a revised ERSST product—would likely benefit from improvements in the ICOADS data and metadata within approximately that same timeframe. However, while very helpful continuing international contributions are anticipated (e.g. UK), making these desired improvements within the proposed update schedule appears highly dependent on adequate resources from the NOAA Climate Database Modernization Program (CDMP; subject to year-to-year uncertainty owing to the special funding basis), as well as on adequate NOAA funding for the ICOADS project (also uncertain).

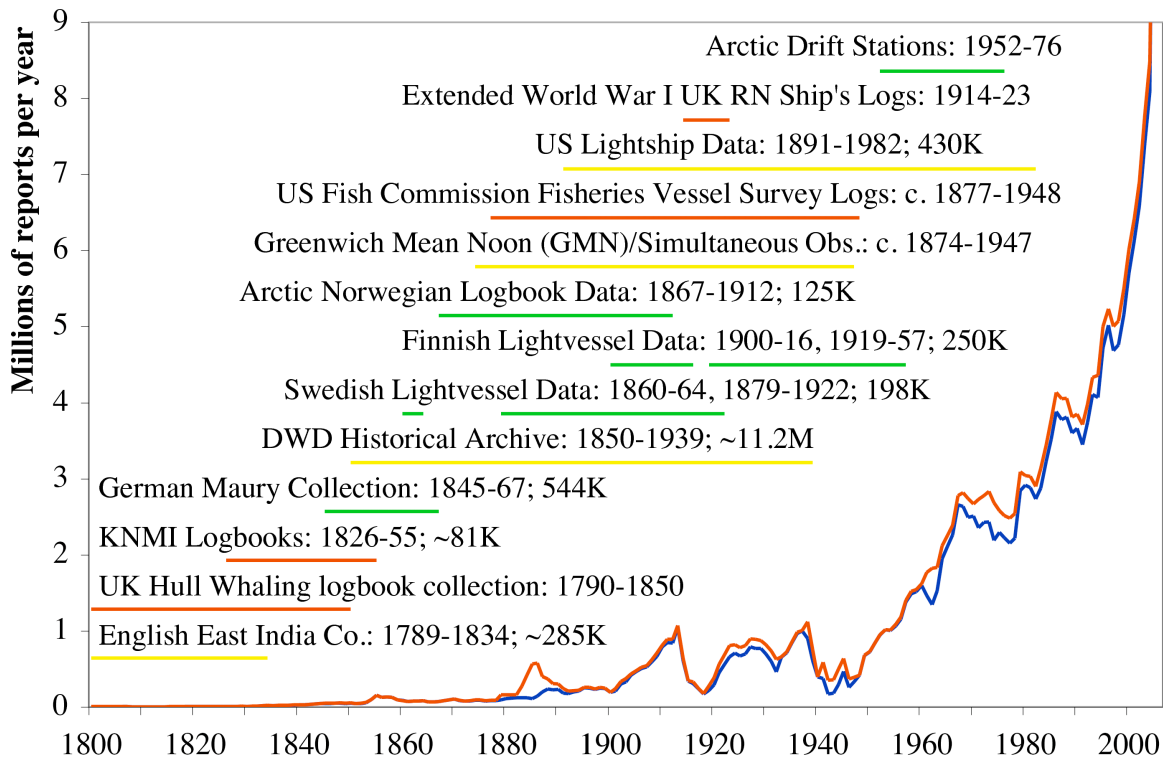


Figure 1. The time periods of selected candidate historical data sources (discussed in more detail in Wilkinson et al. 2010) to be blended into ICOADS, are spanned by horizontal colored lines: green candidates are fully digitized but require format translation, yellow are partially digitized, and red are in the planning stages for digitization. Each dataset name is appended with the date range and approximate number of reports (if known). The solid blue curve is the number of reports in ICOADS Release 2.4; the solid red curve is the number in Release 2.5 (R2.5). We hope that datasets available by roughly early 2011 can be included in the next major ICOADS ("R2.6") required by around the start of FY2012 to meet reanalysis requirements.

This document brings together background and status information for a number of historical marine datasets already in digital form, or planned for imaging and/or digitization by CDMP or related international initiatives, and targeted for blending into ICOADS, either as part of the proposed update to support reanalyses, or later updates. Fig. 1 compares the temporal coverage and size of selected major candidates, with existing ICOADS temporal data density.

Brief summaries are provided in sec. 2 for each of the selected historical collections shown in Fig. 1, and in sec. 3 for a number of important additional collections. As part of the collection summaries, timing goals for three major steps—imaging, digitization, and translation into the International Maritime Meteorological Archive (IMMA) format (Woodruff 2007)—are estimated. Annexes A-F provide detailed additional information in a number of areas including Dutch, German, UK, and US initiatives and collections; and Annex G summarizes the archival location and characteristics of a number of prominent collections, including (if applicable) the location of the imaged forms within CDMP's Environmental Document Access and Display System (EDADS).

Significant additional time and resources (not yet estimated in detail) will also be needed to: (a) adequately assess in advance the quality of new data sources

before they are blended into ICOADS; (b) implement the blend (i.e. additional QC including data preconditioning, duplicate elimination, and further steps required to make the observations and products ready for users; we note however that only the individual observations are likely needed for reanalyses/SST analyses).

As further US background, Fig. 2 focuses on the status of merchant and Navy logbook data, highlighting major undigitized collections, including areas for possible remedial work (with additional details provided in Annexes D-F). Fig. 3 illustrates some of the temporal characteristics of the US Merchant Marine 1912-46 Collection (already within ICOADS), which could be important to consider because the corresponding original records form part of the Greenwich Mean Noon (GMN)/Simultaneous Obs. (see sec. 2.8), as shown in Figs. 1-2.

For several additional UK-related or other international collections (Annex A), joint funding and extensive additional cooperation have been obtained for example through the UK Met Office and the Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative (<http://www.met-acre.org/>); and many metadata, inventory results, and historical documents associated with these efforts are becoming available via the RECOVERY of Logbooks And International Marine data (RECLAIM) Project (<http://icoads.noaa.gov/reclaim/>; Wilkinson et al. 2010).

It is important to draw a distinction between the instrumental data discussed in much of this document, and the existence of many years of even earlier non-instrumental data in, for example, early US Navy (Fig. 1) or UK Royal Navy (RN) logbooks. Generally that transition occurs after the Brussels Maritime Conference of 1853 (Maury 1854), which recommended a set of international observing and reporting practices for keeping “Abstract Logs” of ship meteorological observations, including a variety of instrumental data. However, the English East India Co. collection (Fig. 1) contains some of the earliest known instrumental marine data.

Another important stratification develops historically in the available record types between logbooks (or “deck logs”), and more specialized meteorological (or oceanographic) records (of which the Abstract Logs and GMN observations discussed above can be considered early examples). NHC (2007) describes US Navy deck logs, for example, as “...a daily chronology of certain events for administrative and legal purposes,” but also including “meteorological phenomena.” Contemporary marine meteorological observations in contrast generally are managed internationally under the Voluntary Observing Ship (VOS) scheme of the World Meteorological Organization (WMO), and are reported for example in specialized nationally-designed meteorological forms (or increasingly via electronic logbooks and other digital mechanisms).

## U.S. Logbook Status

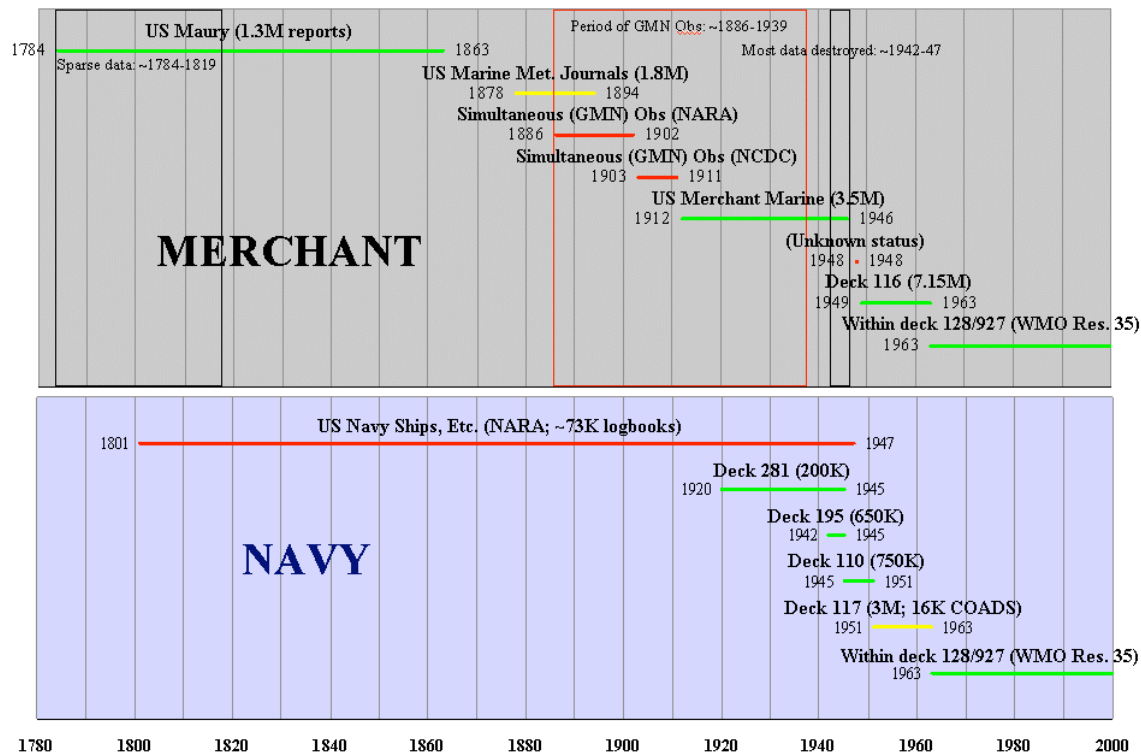


Figure 2. The US National Archives and Records Administration (NARA) and NCDC both have responsibility for wide ranges of merchant and military logbooks (or later meteorological forms), with lines on the above figure indicating their temporal ranges: red=undigitized, yellow=digitized but not yet blended, green=blended into ICOADS [note: this figure needs to be updated in several respects, including that the Marine Met. Journals were blended into R2.5; and since NARA holdings of US Navy Ship logbooks presently extend through 1976, since those records are transferred after a 30-year delay (NHC 2007)]. See also Annex D for further detailed information used to develop this figure. Notes regarding two potential future CDMP remedial data-improvement projects:

- At least some US logbook data for a period starting around 1995 are undigitized (or incompletely digitized). A new marine processing system (MOPS, earlier called MOPUP) introduced at NCDC around then had a goal to save money by minimizing keying (relying more on GTS receipts), but that system introduced some data problems. The cessation of keying of US Navy data apparently extended over a longer period (see Annex D). [Note: figure also needs to be adjusted to accurately reflect this issue.]
- As discussed in Slutz et al., 1985 (p. 23, Cautions regarding “Bucket Indicators”) the SST measurement method indicators for US-recruited data from 1968 through approximately May 1973 are believed to be unusable due to long-past processing errors, resolution of which (e.g. by sample re-keying to diagnose problems, or probably best by full re-keying using modern techniques) could form a very useful CDMP data improvement project at some point, in view of the key role of SST data in climate research.

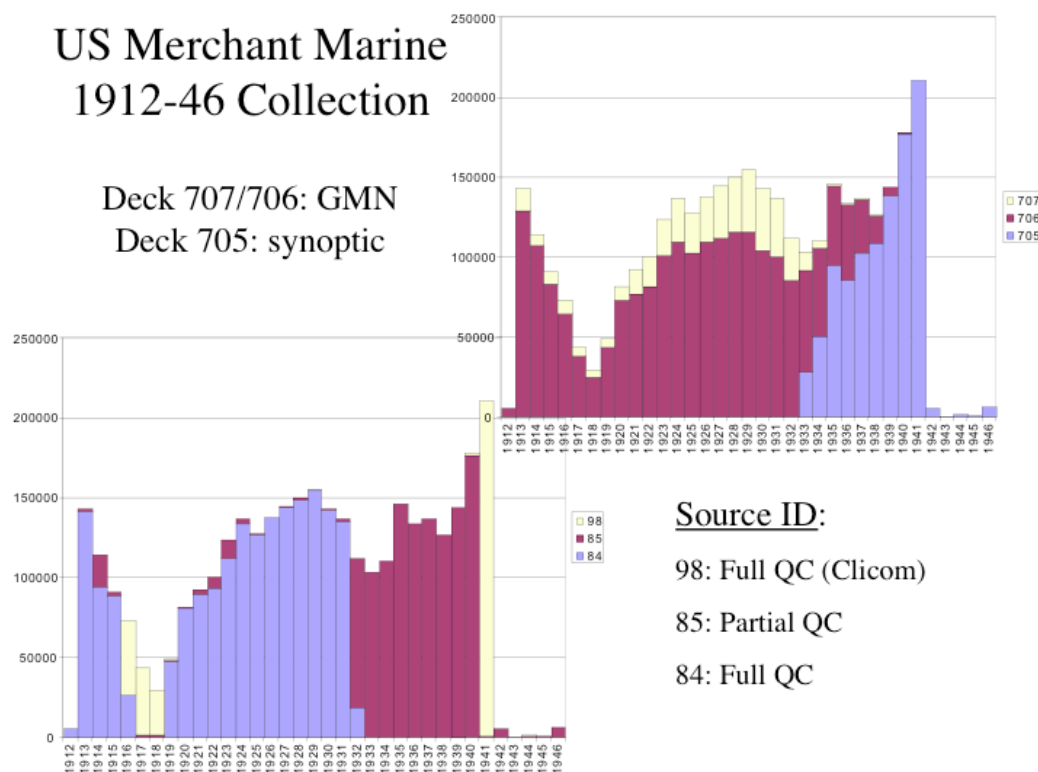


Figure 3. Temporal distribution of the US Merchant Marine 1912-46 Collection by deck (705-707) and source ID (SID; 84-85, 98), consisting of 3.5M reports blended into ICOADS Release 2.0. These data were digitized through a lengthy NCDC project initiated in 1989 (Elms et al. 1993), which ending up transitioning through three different QC schemes (as reflected by SID). Note that GMN records (sec. 2.8) were used for two of the decks.

## 2. Status of Future Blend Candidates (Fig. 1)

Portions of the following background information are taken from Woodruff et al. 2005 (henceforth WEA05) and from Wilkinson et al. 2010, as noted. Goals are indicated as applicable for imaging, digitization, and translation into the IMMA format (Woodruff 2007).

### 2.1 English East India Co.: 1789-1834; 285K (daily) to <6.8M (subdaily)

Background: Through a cooperative project with the international ACRE initiative, linked to the UK Met Office Hadley Centre, a selection of approximately 1K logbooks containing early daily instrumental data (i.e. air temperature, SST, and sea level pressure) have been imaged by the British Library, and is being digitized by CDMP (limited to forms containing? instrumental observations, and neglecting most of the subdaily wind and weather observations due to budgetary considerations).

Imaging: completed in 2009

Digitization goal: 2011

Translation goal: 2011

## **2.2 Hull City Library Merchant and Whaling Logbooks: 1798-1861**

Logbooks from the Hull City Library Archives hold numerous logbooks of voyages from Hull to the high polar latitudes. The observations consist of non-instrumental observations, but are compensated for by the value of daily wind force, wind direction and ice cover data for the very far northern latitudes. Latitudes were rarely recorded and longitudes never recorded. The overall collection is subdivided as follows:

### **2.2.1 Hull Archives Merchant Logbooks: 1798-1835**

Fourteen logbooks of merchants were secured from the Hull City Library Archive and were supplied to CDMP by Dennis Wheeler. These cover voyages from Hull, across the North Sea to the Baltic, with one exceptional voyage from London, UK to Lisbon, Portugal. Includes multiple voyages of the vessels *Bridget*, *John and Sarah*, *Resource*, *Retrieve*, and *Samuel Spyvee* from 1798-1805 and 1834-35.

Imaging: received by NCDC as digital images (jpg format)

Digitization goal: (to be decided)

Translation goal: (to be decided)

### **2.2.2 Hull Archives Whaling Logbooks: 1812-1861**

Similar to the Hull Merchant logs (ref 2.2.1), the original whaling logbooks are located at the Hull City Library Archive in the UK. Three rolls of microfilm of early logbooks received by CDMP from Dennis Wheeler (University of Sunderland, UK) in 2006 covering the period from the early to mid-C19th. There are over forty-two whaling logs from voyages aboard ships such as *Andrew Marvell*, *Brunswick*, *Cumbrian(?)*, *Eagle*, *Exmouth*, *Laurel*, *Margaret*, *Favourite Nancy*, *Neptune*, *Orion*, *Progress*, *William*, *Swan*, *Royal George*, *Duncombe*, *Volunteer*, *Dordon*, *Truelove*, and *Ariel*. The microfilm has been converted to digital images, but quality of the microfilm was often times very poor and some images were not recoverable. Dr Wheeler will investigate other alternatives for imaging these logs. Other whaling logbooks exist in UK archives (see Annex A) and this exercise relates only to those held in Hull City Library. The Hull collection is the largest such gathering of whaling logbooks in the UK, over 90% of the UK stock of such logbooks.

Imaging: Received by NCDC as microfilm; microfilm converted to digital images in 2009, but will need to be revisited due to poor quality

Digitization goal: (to be decided)

Translation goal: (to be decided)

## **2.3 KNMI Logbooks: 1826-92**

A collection of Dutch logbooks (~193; 17.5K logbook pages) from the 19th century, planned for digitization by the CDMP, as resources permit (see also Annex B).

Imaging: completed in 2009 (by KNMI)

Digitization goal: (to be decided)

Translation goal: (to be decided)

#### *2.4 German Maury Collection: 1845-67; 544K*

Background: Loaned to the US by the Deutscher Wetterdienst (DWD) for imaging (Braun 2000), and digitized by CDMR. The translation into IMMA format will likely require attention to some issues of data homogeneity with the US Maury Collection (WEA05), and characteristics of (at least) the US Maury data (e.g. biased pressure observations) still being studied by KNMI (Wallbrink, 2008).

Imaging: completed in 2005

Digitization: completed in 2006

Translation goal: 2010

#### *2.5 DWD Historical Archive: 1850-1939; 11.2M*

Background: (See Annex C.)

#### *2.6 Swedish (1860-64, 1879-1922) and Finnish (1900-16, 1919-57) Lightvessel Data*

Logbooks were imaged from the US National Oceanographic Data Center (NODC), Swedish Meteorological and Hydrographic Institute (SMHI), and Finland Institute of Marine Research (FIMR). A combination of oceanographic (e.g. temperature, salinity, and current speed and direction) and meteorological (e.g. air temperature, wind, and barometric pressure) data was digitised from the collections. The Swedish data were collected in the Skagerrak, Kattegat, Baltic Sea and Gulf of Bothnia by 14 Swedish Lightvessels, and the Finnish data in the Baltic Sea, Gulf of Finland and Gulf of Bothnia by 32 lightvessels.

Imaging goal: completed

Digitization goal: completed (data are available on CD-ROMs)

Translation goal: (to be decided)

#### *2.7 Arctic Norwegian Logbook Data: 1867-1912; 125K*

Background (from WEA05): Digital records supplied in 1999 by the Norwegian Polar Institute (<http://dss.ucar.edu/datasets/ds539.1/>). This collection extends past the period (1867-99) of the 600 logbooks from which the Norwegian Logbook Collection (deck 702; 1867-89; 201K reports) included in Release 2.0 was extracted (see Woodruff et al. 1999). However, only SST and air temperature data were keyed. Unfortunately, no active contacts currently exist with Norway to explore the possibility of imaging/digitizing additional data, but this should be pursued if possible in the future. It is also important to note that the earlier project digitizing deck 702 only succeeded in keying about 1/3 (200 logbooks) of that collection.

Imaging: it is not known if any of the 600 19th century logbooks, or additional logbooks e.g. extending through 1912, were ever imaged by Norway (ref. also Table A1)

Digitization: completed by 1999 (highly abbreviated records, however)



Translation goal: (not yet established, assuming these abbreviated records are worth including in ICOADS)

## 2.8 Greenwich Mean Noon (GMN)/Simultaneous Obs.: ~1874-1947

Background (adapted from WEA5): Around 1888, the US started switching from the systematic observations made throughout the day in its Marine Meteorological Journals, to “simultaneous” observations taken once daily worldwide at Greenwich Mean Noon (GMN, i.e. 12:00 UTC). These GMN observations make up many of the records in the 1912-46 collection until the 1930s (Fig. 3). The change was made to construct daily synoptic weather charts, and in hopes that “the number of observers would increase in the same ratio as the services required of them would diminish” (Page, 1901). However, modern climate analyses may need to carefully weigh the method of including these data (which prior to 1912 are largely undigitized), so as to avoid introducing false variations, due to observations made at different times in the diurnal cycle (e.g. some locations were only observed during the day—others only at night). The overall collection is subdivided as follows, with additional background provided in Annex E:

2.8.1 *Published: Weather Bureau Bulletin of International Simultaneous Observations 1875-89* (ref. MWR, 1914, which also notes a “valued supplement in the *Tägliche synoptische Wetterkarte des Nordatlantischen Ozeans*, issued jointly by the Deutsche Seewarte and the Danske Meteorologiske Institut beginning with 1884”). Daily observations concluded on 30 June 1884 and thereafter continued on a monthly or semi-annual basis through the remainder of the period of record. Semi-annual publications for 1888-89 have yet to be located.

Imaging goal: completed in 2009

Digitization goal: 2010

Translation goal: 2010

## 2.8.2 *Records of Simultaneous Meteorological Observations on Ships 1886-1902*

Imaging goal: completed in 2009

Digitization goal: 2011

Translation goal: 2012

## 2.8.3 *Records of International Simultaneous Ship and Land Observations 1874-92*

Imaging goal: (TBD)

Digitization goal: (TBD)

Translation goal: (TBD)

## 2.8.4 *GMN Monthly and Daily Marine Forms (1910-47)*

“Daily Journal,” “Fog,” and “Gale” reports contained on separate pages within the daily observations were imaged, but are not being digitized, and should be considered for later digitization.



Imaging goal: completed in 2009  
Digitization goal: 2011/12  
Translation goal: 2010

### *2.9 US Fish Commission Fisheries vessel survey logs: c. 1877-1948*

Background: Original logbooks of the US Commission of Fish and Fisheries vessels (and its successor agencies) are archived at the Smithsonian ([siarchives.si.edu/findingaids/faru7184.htm](http://siarchives.si.edu/findingaids/faru7184.htm)), and at the NARA facility in College Park, MD (Record Group 22; <http://www.archives.gov/research/guide-fed-records/groups/022.html>). Among the environmental variables recorded are depth, character of the bottom, weather, air and ocean temperature, barometric pressure, winds, salinity, currents, and species brought back from the trawls or dredges at specific time, for specific locations. An initial FY2008 CDMP imaging project established the groundwork to a follow-up project where the geo-referenced biological, oceanographic, and marine meteorological data from these logs are being digitized for inclusion in ICOADS and the World Ocean Database Project (<http://www.nodc.noaa.gov/General/NODC-dataexch/NODC-godar.html>). Approximately 100 additional logbooks from fisheries survey vessels were identified in 2009 that are recommended for imaging and digitization. These logs are archived at NARA RG22 (Archives II) and RG24 (Archives I) (see also Annex D). These include primarily deck logs of survey vessels that document temperature, pressure, and weather conditions in a standardized format.

Imaging: completed in 2009 (only for the survey logs)  
Digitization goal: 2012 (only for the survey logs)  
Translation goal: 2012 (only for the survey logs)

### *2.10 US Lightship Data: 1891-1982; 430K*

Background (from WEA5): Observations from ships anchored around the US coastline, most recently operated by the Coast Guard, as an aid to navigation (Annex F provides additional background. Similar historical data exist for the UK and Ireland, which should be digitized at some point. The UK still operates a few lightships: [http://www.metoffice.gov.uk/research/ocean/goos/maws\\_pic.html](http://www.metoffice.gov.uk/research/ocean/goos/maws_pic.html), from which digital data should exist.).

Imaging: completed  
Digitization goal: 2010  
Translation goal: 2010

### *2.11 Extended WWI UK Royal Navy (RN) Ship's Logs: 1914-23*

An extended period during and following World War I (1914-23), 7-8K Royal Navy Ship's Logs held in the UK National Archives (following on from previous joint US-UK work on data for the World War II period, Brohan et al. 2009).

Imaging: being completed by the UK National Archives  
Digitization: proposed for consideration as a CDMP task  
Translation goal: (to be decided)

### *2.12 Arctic Drift Stations: 1952-76*

Background: These data (many different formats) were collected and organized by NCDC and NSIDC leading to the production of the Arctic Climatology Project (2000) CD-ROM. The complete collection (1893-1976) is archived at NCAR (<http://dss.ucar.edu/datasets/ds258.2/>) and includes data from Western Arctic ice drifting stations AIDJEX, ARLIS I, ARLIS II, Ice Station *Alpha*, Ice Station *Charlie*, and T-3 (called Ice Station *Bravo* during IGY), and from the North Polar expeditionary ships *Maud* and *Fram*. Only some of the data, including from the *Maud* and *Fram*, were blended into R2.0.

Imaging: (not applicable)

Digitization: completed c. 2000

Translation goal: (to be decided)

### 3. Status of Additional (to Fig. 1) Blend Candidates

#### 3.1 US Navy Hourlies: 1952-64; ~3M (deck 117)

Background: Only 16K reports from deck 117 were included in COADS Release 1, which were blended in from TDF-11 format (not the original card deck 117 format; ref.: <http://icoads.noaa.gov/deck117.html>). Note that these 16K reports may provide valuable validation information for a new conversion from the original card deck format into IMMA. Also some deck 117 records were tapped to fill gaps in Arctic Drift Stations (sec. 2.12; ref. Table 1 in Elms et al. 1993).

Imaging: (apparently not applicable, but the status of the original records is not presently known)

Digitization: completed c. 1957 (original card deck reference manuals available here: <http://icoads.noaa.gov/reclaim/us.html>).

Translation goal: (to be decided)

#### 3.2 Chinese/GODAR Ships: 1968-93; 424K

Background: As part of Global Ocean Data Archeology and Rescue (GODAR) project, surface marine ship data were digitized in China. The data were received at NCAR (<http://dss.ucar.edu/datasets/ds541.4/>) from NCDC on CD-ROM.

Imaging: (not applicable)

Digitization: (not applicable; data published/available on CD-ROM)

Translation goal: (to be decided)

#### 3.3 DM buoy/ODAS data (e.g. Canadian): early 1970s-date

Background: A variety of delayed-mode (DM) buoy or other automated Ocean Data Acquisition System (ODAS) data fall into this category and should be considered for addition to or updating in ICOADS as resources permit, including:

- An update of the NDBC moored buoy and Coastal-Marine Automated Network (C-MAN) archive (format F291; NCDC DSI-1138) was translated into IMMA format (based on NODC's archive, followed by an intermediate translation into NCDC's abbreviated DSI-1171 format) for partial blending into R2.5.

Imaging: (not applicable)

Digitization: (not applicable)

Translation goal: completed c. October 2008

- Worldwide drifting buoy data from Canada/ISDM (formerly MEDS) were last updated as part of R2.2 (completed in 2005, data extending through 2004; <http://dss.ucar.edu/datasets/ds256.0/>).
- Tropical Pacific/Atlantic moored buoy data for the TAO/TRITON and PIRATA arrays were obtained from PMEL and JAMSTEC, and also last updated as part of R2.2 (<http://dss.ucar.edu/datasets/ds256.1/>).
- Canadian moored buoy data (1970-November 1998, obtained from Val Swail Feb. 1999; <http://dss.ucar.edu/datasets/ds256.3/>).

#### *3.4 Baltic Sea Marine Surface Observations: 1961-90; 360K*

Baltic Sea ship data (<http://dss.ucar.edu/datasets/ds258.3/>), resulting from a project described in WMO (1998).

Imaging: (not applicable)

Digitization goal: (not applicable)

Translation goal: (to be decided)

#### *3.5 Canada/MEDS Daily Seawater: 1914-85*

Daily time series of water temperature and salinity (plus some surface wind data) collected at various points on the Western and Eastern Canadian coasts (<http://dss.ucar.edu/datasets/ds257.0/>).

Imaging: (not applicable)

Digitization goal: (not applicable)

Translation goal: (to be decided)

#### *3.6 Bering Sea Crab Data (Pilot House Log and R/V Records): 1966-74*

Historic eastern Bering Sea crab data includes survey results and fishing data on crab abundance that contain embedded environmental data, including surface weather observations, as well as bottom temperatures. Among the logs, the environmental variables recorded are time and location of observations, ship's heading, Loran readings, barometer, wind direction and speed, sea and swell heights, and clouds (amount). Other forms contain sub-surface observations as well [note: more info needed here]. Imaging and digitization began in 2008 and will be completed in 2010. Data are being keyed in a "csv" (comma separated value) format.

Imaging goal: 2010

Digitization goal: 2010

Translation goal: 2010

#### *3.7 Ukrainian Marine Data: 1958-85*

During 1999-2001, Alex Polonsky from the Ukraine provided for ICOADS digitized marine surface observations (approximately 52 cruises totaling over 4K reports; generally containing wind, AT, and SLP data, with lower frequencies of clouds, waves, etc.; being archived within: <http://dss.ucar.edu/datasets/ds530.0/>).

Imaging goal: (not applicable)

Digitization goal: (not applicable)

Translation goal: (to be decided)

### *3.8 US Tide Gauge Meteorological Observations: ~1854-forward*

Steve Lyles (NOAA/NOS, now retired) indicated 2 January 2009 that earlier meteorological (e.g. SST) observations, such as from the station established 30 June 1854 in San Francisco, have not been digitized (note: however some data have been digitized for research, e.g. Maul et al. 2001), and older records have been transferred to NARA from NOS. Some original records may be described at <http://www.archives.gov/research/guide-fed-records/groups/023.html> under item 23.4.2 (Scientific records) as 'Meteorological observations and water temperature and density readings ("TW" Series), 1845-1911.'

Imaging goal: (to be decided)

Digitization goal: (to be decided)

Translation goal: (to be decided)

### *3.9 Mariner's Museum (Newport News, VA) Private Logbook Collection (C17th-)*

Via Lin Chambers ([Lin.H.Chambers@nasa.gov](mailto:Lin.H.Chambers@nasa.gov)) we learned (March 2009) about a private collection of ~400 ships' logbooks or journals:

"A few from 1690s (probably copies). Lots from 1800s. Some from 1700s. Ends late 1960s/early 70s. Some are account books or journals rather than logbooks. Logbooks include lat/long, temp, weather conditions. [...] Mostly North Atlantic, Coastal, Chesapeake Bay. Not exclusively; some worldwide. Nothing has been mined yet. Would require researcher or intern. A datasheet may exist on each logbook. Done by volunteers. Handwritten. There is an Access Database with at least some info about each item."

We plan to contact Bill Barker ([bbarker@marinersmuseum.org](mailto:bbarker@marinersmuseum.org)) about the possibility of obtaining example images and for additional information.

Imaging goal: (to be decided)

Digitization goal: (to be decided)

Translation goal: (to be decided)

### *3.10 US Weather Bureau North Atlantic Thermograph Program (pre-WW2)*

From Kevin Wood (7 May 2009; ref. Church 1937; see also Brooks 1930, Brooks and Fitton 1930):

"It looks like a significant number of ships on scheduled (e.g. weekly) liner service were equipped with recording thermographs beginning in the 1920s with the intent of investigating the western Atlantic - Gulf Stream system. Such that in a 1937 paper by P.E. Church we find that by 1933 some 100 synoptic charts based on ~1200 thermograph records had been constructed. I would think this material—if it could be found again—would be rather interesting in light of current interest in low-frequency variability and potential climate implications related to WBCs. Certainly our work on the early 20th c. warming points in this direction. I don't know what the benefit might be over the current ICOADS-based products if the charts/and or thermographs were relocated, but it seems that some features like the position of the cold wall, eddies and so forth could be resolved a bit better. I've attached a map showing the steamship routes across the GS and a chart of annual average from the Church paper."

## References

(Note: references marked † are available in electronic form at <http://icoads.noaa.gov/publications.html> and publications marked †† at <http://icoads.noaa.gov/reclaim/selected.html>)

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## **Annex A: Additional RECLAIM and ACRE-Related Activities**

**(C. Wilkinson, D. Wheeler, R. Allan, P. Brohan)**

### **2009 Accomplishments**

#### *Extended WWI Royal Navy (RN) Logbooks: 1914-23*

A sum of GB£111K (US\$200K) from Defra/MoD was allocated for imaging, which commenced in October 2008. Under RECLAIM a shortlist of logbooks with relevant statistics and a detailed set of movement records was provided. As a result of sufficient lead-in time, this listing is superior in quality and detail to the corresponding WWII initiative (Brohan et al. 2009) and will hopefully yield far less in-port met data. Initial funding was expected to produce about 294K images. Due to subsequent budget restraints, there are likely to be no more than c. 150K images. There are presently no funds available beyond imaging, and therefore digitization of the images will require additional resources (possibly from CDMP; ref. main sec. 3). Presently (March 2010), funding is being sought to digitize the available images through a pilot project in “citizen science,” whereby the public are able to digitize data on-line after the fashion of the Galaxy Zoo Project (<http://zooniverse.org/home>).

#### *Ships of Exploration/Survey Vessels/Colonial Met Registers*

Funding for a project encompassing “Expeditions, travels, circumnavigations and ships of exploration” and colonial met registers was secured from the Joint Information Systems Committee (JISC), and success confirmed in August 2008. Work on the CORRAL Project “COLonial Registers and Royal navy Logbooks” (<http://www.corral.org.uk>) began in October 2008 and was completed December 2009, with monies covering both imaging and selected digitization. Catharine Ward identified vessels of exploration (ADM 55), and the logbooks of ships attached to the Hydrographic Survey of the RN that contain instrumental data; the latter began c. 1830s whereas ADM 55 spans both the 18thC and 19thC. There are 194 logbooks, six of which are meteorological journals. A significant proportion of ADM 55 has instrumental data, prior to about 1820. These items are presently on microfilm and all have been imaged at high quality and made freely available through the British Atmospheric Data Centre (<http://badc.nerc.ac.uk/data/corral/>)

The “Colonial Met Registers,” kept at lighthouses, and at St Helena (South Atlantic) and Malden (Pacific) islands, are a collection of meteorological registers kept in the National Meteorological Archive, and housed at the Devon Record Office in Exeter, and have been imaged as part of the CORRAL Project.

### **Plans for 2010 and Beyond**

#### *UK Hydrographic Office Remark Books*

The inventory of remark books was completed in 2008 and funded through ACRE by the UK Met Office Hadley Centre’s Integrated Climate Project [Note from Annex D that US NARA includes in RG37 “(‘Daily Remark Books’, 1866-75”]. A report with input from the two research assistants has been produced and includes estimates of numbers of observations of pressure, air temperature and SST. It is now possible to give a good estimate of images and therefore probable costs to process all or part of the collection as a first step to bidding for funds. There is duplication between the remark books and the (ADM 53) RN deck logbooks. While before the 1850s the RN logs may not all contain instrumental meteorological data, certainly after 1860/70 they will. The chief advantage to imaging the remarks books is cost. In the deck log each image will cover one day. In the remark books there will be multiple days, anything from 10 days up to an entire month in one view. Some of the remark books will also contain more sub-daily data and there is a modest amount of sub-surface sea temperature data. It is essential however that corresponding deck logs and remarks books are compared to ensure consistency and accuracy of recording between the two, as part of a pre-imaging QC exercise. Unless funds appear suddenly (as with JISC) it is unlikely that any imaging will start before 2011.

There is an additional modest project feasible at the UKHO involving the digitization of subsurface sea temperatures. These are to be found in printed books. There may be more material in manuscript and printed form but these have not yet come to light. Furthermore, “draft sailing directions” housed at the Hydrographic Office may provide additional material and should be investigated.



Andrew Cook (UK) pointed out that the USNO has an extensive series of books for chronometers aboard US ships (see Annex D) and (with further inquiries being initiated in the UK) that: "The UK index to chronometer records is in NMM, I think, or in RGO records. It was necessary, in assessing the going of chronometers, to establish the ambient temperature and relative humidity, for the effect on the coiled spring. If these are preserved for chronometers on voyage, and if the daily geocoordinates of the voyage are also available, in the chronometer of elsewhere in journals, you might find you have further series of oceanic observations."

#### *Whaling Logbook Project*

The Universities of Hull and Sunderland together with the British Arctic Whaling Group (<http://www.hull.ac.uk/baw/overview/overview.htm>) have been attempting to secure funds with which to explore the collection of UK whaling ship logbooks, some of which date back to the late 18thC and which number over 200. The data are exclusively non-instrumental but references to wind force and direction and to ice cover will be valuable particularly for this period.

[Note from sec. 2.2.2 of the main text that three rolls of microfilmed whaling logbooks from the Hull Archive arranged by Dennis Wheeler in 2006 have been archived by NCDC/CDMP, but further digitization work or possible availability of the images on EDADS awaits CDMP or external funding. Due to poor quality of the images, other options will have to be explored in order to have useful logbook images.]

#### *Printed Met Data from Online Scans, Books, and Journals*

This activity (ACRE funded) is ongoing and presently limited to a single person (Gail Willetts) digitizing data from a variety of sources ranging from the 18thC to 20thC. Observations from a dozen expeditions from the heroic age of Antarctic exploration (1896-1940) have been digitised and translated, as have observations from the US Exploring and *Challenger* expeditions in the late 1830s-early 1840s and 1870s respectively. Some of these collections were blended into ICOADS Release 2.5. Three more expeditions (William Parry's first, second and third North West Passage voyages) have been digitised and translated as a contribution to the CORRAL project. Records from several other expeditions have been digitised, but not yet translated. These include notable English and French explorations and circumnavigations in the 19th Century. RECLAIM has provided a list of books and journals of which 800 are of marine met or oceanographic interest. Many of these printed journals and other publications contain tabulated met. data. In this area ACRE and RECLAIM are pooling resources and expertise. This is very much an on-going exercise with great potential.

#### **Other Items**

##### *UK Met Office Ships' Met Logs*

There is a need to make additional comparisons between WWII logs already digitized and the corresponding Met Logs at the UK Met Office (building on the results of limited comparisons, including with UK Marine Data Bank data versions digitized many years ago, available from [http://icoads.noaa.gov/ukrn\\_ww2\\_mdb.html](http://icoads.noaa.gov/ukrn_ww2_mdb.html)). However the Met Logs as a collection stretch back to the mid-1850s and appear superior in many respects to the corresponding RN ship's (deck) logs, e.g. in terms of cost (more data per image) and probably the quality of the observations (and include instrumental and platform metadata frequently not present in the deck logs [see metadata below]). Again both the deck and Met Logs of selected vessels should be compared as part of an initial QC exercise. Several inventories have been started (RN complete to 1890 and merchant shipping, eastern Pacific 1880s complete) but there are up to 4K separate items most of them from merchant vessels. A few weeks work would see this complete and it is an essential first step to further progress.

##### *Australian Joint Copying Project*

Extensive literature on this project has been passed to ACRE/RECLAIM, through Sara Joynes from the National Library of Australia, Australia House in London. From 1948-93, materials in British archives concerning the history of Australia and the surrounding region were copied to microfilm. These included extensive numbers of UK ships' logbooks. Future logbook

digitization projects may be able to take advantage of the fact that a significant quantity of imaging has already been achieved.

*Logbooks kept in the National Archives of Australia and New Zealand etc. (Table A1)*

The Australian and New Zealand holdings are on-line and have been viewed to some extent when working on WWII and WWI material, as several RN ships were transferred or lent and their logbooks are therefore in those countries rather than the UK. Australia in particular has archive material back into the 19thC including some RN logs for that period. Australian and New Zealand probably will need to be contacted separately to find out the status of these holdings, and any planned digitization efforts.

*ACRE Chile*

In April 2009, a delegation representing ACRE, RECLAIM and the Scott Polar Research Institute, made a visit to Chile to investigate the possibilities of joint terrestrial and marine digitization projects. A visit to the Chilean naval museum in Valparaíso identified over 6K Chilean naval logbooks dating from 1870, but mostly 20thC. Inquiries are also underway with the Chilean Hydrographic Service (SHOA) to ascertain the existence of "Remark Books" or something similar in their archive. Efforts to help eventually facilitate a proposed project to image and digitize Chilean marine data and to set up the necessary infrastructure for future projects are presently in hand with another visit to SHOA, the Naval Museum and Meteo-Chile taking place. The potential data from such a project would cover the SE Pacific, which is presently data sparse. A separate report will become available by approximately June 2010.

*Royal Navy Eastern Pacific Logbooks 1790-1913.*

In anticipation of a Chilean marine data digitization project, 904 corresponding Royal Navy logbooks for the eastern Pacific have been identified, their movements documented and the relevant ship platform metadata assembled. Provision has also been made to gather instrument metadata, which is expected to be present for vessels from c. 1875 onwards. An initial estimate of images and costs indicates 305K images costing about £155K (\$250K). The minimum output from this project would produce 185K days of sub-daily pressure data and 100K days of sub-daily SST. Sub-daily observations number six per day in most instances. The area covered is the NE and SE Pacific from the Bering Strait to Cape Horn, and extending westward to the longitudes of Hawaii and Easter Island. All circumnavigations have also been included.

*Royal Navy Indo-Pacific Logbooks 1800-1913*

A similar exercise has identified the corresponding Royal Navy logbooks covering the western Pacific, [China and Australian stations,] Indonesia and the Indian Ocean. This inventory is complete and will provide the basis of a further digitization project. At the present stage, no estimates of images and costs can be provided.

*Records of the Sea Mammal Research Unit (SMRU)*

This collection is held at St. Andrews University, Scotland, and includes British Antarctic Whaling Records 1924-1966. Whale fishery catch books, and inspectors' logs, record daily barometric pressure and sometimes sea temperatures. SMRU also has separate records (field notes) of sea temperature. An example of a whale fisher catch book (a duplicate of one archived at St. Andrews) is held at the Climatic Research Unit, University of East Anglia. The collection has been documented and an inventory of the holdings has been made, including sample images from the catch book held by CRU. The collection consists of items from 15 different factory ships operating in Antarctic waters (1924-1966), with 96 catch books, 35 sets of field notes and 32 inspectors' diaries.

*French National Archives*

A collection has been identified in Series JJ Hydrographic Service. This includes scientific observations (3JJ) and *journaux de bord* or logbooks (5JJ) as well as other papers related to early surveys and explorations by the French Navy. The collection requires documentation and assessment and at present no further detail is available.

### 19<sup>th</sup> Century Indian Navy Logbooks

The India Office of the British Library holds 49 logbooks of the early Indian Navy. These vessels were commanded by officers of the British Royal Navy and the collection is part of the same series as the East India Company journals. Geographic coverage is mostly confined to the Bay of Bengal and Arabian Sea, with some vessels operating further afield in the East Indies and Chinese waters. A few of the logbooks cover voyages from the UK to India. The logbooks date from the 1830s through to the 1850s. It is likely that some of the logbooks will have instrumental meteorological observations, although this must be confirmed. An inventory of the collection has been made.

Table A1. Additional miscellaneous international projects or proposed projects (adapted from: <http://icoads.noaa.gov/etmc/etmc2/etmc2-docs/ETMC2-Doc-4.4-Logbook.pdf>).

- French historical logbook microfilm records and documentation (R. García-Herrera, Spain)
- Canadian Hudson Bay Company (HBC) and N. American Royal Navy logbooks (V. Swail, Canada), plus historical Arctic efforts (R. Przybylak, Poland)
- Australian ships' logbooks (~1,300; 1855-1982) (W. Wright, Australia; R. Allan, UK)
- New Zealand logbooks (e.g. 3K covering 1936-94) (C. Wilkinson, UK)
- South African (Capetown) logs and harbor master records (1820-60s) (C. Wilkinson, UK; et al.)
- Norwegian (1785-1870) logbooks (A. Mjaland, Norway; C. Wilkinson, UK)
- Chinese Maritime Customs Project meteorological data (R. Bickers, UK; R. Allan, UK)

### Metadata

Much of the early UK 20thC Ship's Logs do not contain instrument or platform metadata and the search for the data is a task that needs to be undertaken. It may for instance be noted in the very first logbook in a sequence for any one commission. (So the first thing to check is EDADS.) The corresponding Met Office Met Logs have some metadata (see above). However for the WWII period, these Met Logs (with some exceptions) are confined to vessels serving as fleet or squadron flagships.

We recommend that in any examination of a logbook (for instance for the Exeter project, the JISC exploration project, or the proposed eastern Pacific Project) the relevant instrument metadata be noted or imaged so that some sort of comprehensive ship metadata inventory can be initiated. Likewise, Clive Wilkinson plans to continue abstracting metadata for SST and met observations from printed sources as they come to light. Once a critical mass of information has been assembled from printed sources and from logbooks, C. Wilkinson will produce a report on instruments and observing methods/instructions, noting in particular historic changes in instrumentation and observing methodology.

At least for international merchant ships, availability of WMO Pub. 47 metadata starting in 1955 (as well as other sources such as the proprietary *Lloyd's List*) should be noted (Kent et al. 2007).

[Note: Mystic Seaport Museum has imaged editions for 1859-83 of *American Lloyd's Register of American and Foreign Shipping*, plus other similar historical ship (and yacht) lists through about 1900, available here: <http://library.mysticseaport.org/initiative/ShipRegisterList.cfm>, e.g. the following example page is from the 1867 *Register*, illustrating that most such information is likely to be confined to platform (e.g. ship size and construction) as opposed to instrumental metadata.]

## STEAMERS.

NAME AND CAPTAIN.	Class	Tons	Decks	Material	Fuel	When Metal- ed.	When Built	Where and by Whom Built	Port Belonging to.	Owners or Consignees	Dimensions.	Mold	Remarks.	Place and Date of Survey.
<b>G</b>														
⊙ G. H. Stout.....		228	1	70	L.		'59	N Brunswick	Phila	W. P. Clyde	123 22 8	M	2 Wm. P. Clyde Riv nav	NY 3, '66
pr Borden														
G. T. Watson.....	1	425	1	8	iron	L.	'62	London	New York	W. Whann	170 22 13	S	So rig 4 bklids x The Kato	NY 7, '64
pr Petras														
Galatia.....	1 1/2	1200	2	14	C. I.		'62	New York	P'tau Prince	R. Murray, Jr	218 35 12	M	So rig 4 comp F S good	NY 10, '65
pr														
★ Galatea.....	1-	1400	1	130	h	C. I.	'64	New York	New York	Prov. & N.Y.S.S.Co	245 40 15	F	4 bklids	NY 2, '67
pr J. M. Jones														
⊙ Gen. Banks.....		750	2	11	iron	L.	'47	England	New York	Whitn'y & Hath'w'y	101 28 13	M	So rig F S good D C	NY 2, '63
pr														
Gen. Burnside.....	1 1/2	387	1	8	iron	L.	'62	Wilmington, D	Phila	R. F. Loper	150 23 17	M	So rig 8 bklids Enclad M dk	Phil 5, '62
pr														
★ Gen. J. K. Barnes.....	1*	n3365	2	140	X	C. I.	'64	New York	New York	H. Livingston	223 35 21	S	So rig DK sails	NY 1, '67
pr Morton														
Gen. Dulco.....	1 1/2-	272	1	70	C. I.		'63	New York	St. Jago	Ducure	122 25 9	M	So rig	NY 10, '65
pr														
★ Gen. Custer.....	2	450	2	140	C. I.		'53	Phila	Georgetown	Morgan & Rhin'hart	156 24 18	M	2 m so rig C bkr Hg k	NY 12, '66
pr														
Gen. Grant.....		1210	3	180	h	C. I.	'63	New York	New York	Wm. F. Weld	216 34 24	M	Shoports F S good x	NY 1, '67
pr														
⊙ Gen. Hooker.....		270	1	60	C. I.		'64	Boston	Boston	McKay & Aldus		F	Enclad M dk Riv nav	Bos 2, '64
pr														
Gen. McCallum.....		n511	1	7	iron	L.	'64	Glasgow	New York	A. Leary & Co		M	So rig	NY 4, '65
pr														
★ Gen. Meade.....	1	893	3	16	iron		'61	Stockton	Boston	Wm. F. Weld & Co	211 30 19	S	Dg rig 5 comp F S good	NY 1, '67
pr														
Gen. Shepley.....	2 1/2	219	1	30	L.		'64	Portland	Portland	Ross Sturdevant		M	Stora wheel Riv nav	Ptd '65
pr														
★ Gen. Sedgwick.....	1*	811	2	120	X	C. I.	'64	Mystic, Ct	Mystic	C. H. Mallory	179 31	S	So rig	NY 4, '66
pr														
Gen. Sherman.....	1 1/2	400	2	100	C. I.		'64	New Haven	New York	N.L. & G. Griswold	136 23 15	M	So rig F S good Sold at Riv	NY 1, '67
pr														
Geo. Appold.....	2	n1370	3	140	h	C. I.	'64	Phila	Phila	Mor. & Min. Tran. Co	223 35 24	M		NY 2, '65
pr														
Geo. G. Collins.....	2	236	1	70	C. I.	S '63	'62	G'd'peed Ldg	Hartford	D. A. Smith	150 28 6	M	Enclad ck furs and aft N	NY 4, '64
pr														
★ Geo. Cromwell.....	1*	n1000	2	140	C. I.		'62	New York	New York	H.B. Cromwell & Co	187 30 15	M	Dg rig N P dk F S good	NY 2, '67
pr														
⊙ Geo. Leary.....		n1271	1	62	C. I.		'64	New York	New York	Leary Bro	231 37 12	S	Prms dk Watr whl guards	NY 4, '64
pr														
★ Geo. S. Wright.....	2	341	1	10	pine	L.	'63	Fort Ludlow	New York	West Union Tel. Co	116 25 10	M	So rig Solid floor	S F 7, '65
pr														
★ Geo. Washington.....	1*	1000	2	140	C. I.		'62	New York	New York	H.B. Cromwell & Co	187 30 15	M	Dg rig L. rope '65	NY 1, '67
pr														
Georgia.....	1-	671	2	136	iron		'63	Dumbarton	New York	Williams & Guion	206 27 14	M	Dg rig 4 bklids F C	NY 4, '66
pr														

## **Annex B: Royal Netherlands Meteorological Institute (KNMI) Marine Data Rescue Activities**

Information from Wilkinson et al. (2010):

In 2009, Royal Netherlands Meteorological Institute (KNMI) produced approximately 17.5K digital images of a collection of Dutch logbooks from the 19th century that resides in the archives of the Institute. These images are planned for digitisation by CDMP, as resources permit. Support in the form of interpretation of the images is given by KNMI.

Under the umbrella of the KNMI project HISTorical CLIMate (HISKLIM) more inventories of national archives and museums will be completed and more historic marine data will be made available (<http://www.knmi.nl/onderzk/hisklim/index-en.html>). Surveys will be conducted to find original logbooks or observations that were used to produce several Dutch atlases and publications in the 19th Century (e.g. Van der Stok 1897). These surveys are in addition to the inventory of the Dutch part of CLIWOC that only concentrated on the period 1750-1850. As resources permit, an investigation into the availability of early Dutch East India Company logbooks (pre-1750) will be carried out.

## **Annex C: Deutscher Wetterdienst (DWD) Marine Meteorological Archive**

(1) Selected DWD data were obtained by NCDC in 1999 from Volker Wagner, and used in cooperation with NSIDC to create a improved dataset for the North Polar expedition of the *Fram* (ref.: Arctic Climatology Project, 2000). The resulting data (1893-96, North of 76°N; 8K reports) are presently available within ICOADS as part of deck 734.

(2) Additional selected DWD data (1884-1914; 833K reports) were obtained by Gil Compo in 2002 from Volker Wagner (since retired from DWD) as two files covering (a) the N. Hemisphere  $\geq 60^\circ\text{N}$  and (b) the Pacific (excepting any data  $\geq 60^\circ\text{N}$ ).

(3) Letter (e-mail only) sent 13 February 2007 to Reinhard Zöllner (Volker Wagner's replacement) from the GCOS AOPC/OOPC Working Group on Surface Pressure (WG-SP) requested urgent consideration by DWD for providing as much as possible of the DWD archive for blending with ICOADS, and indicated 1880-1948 as the main period of interest.

(4) At the Second Session of the JCOMM Expert Team on Marine Climatology (ETMC-II), Mr Zöllner described historical marine digitization activities at DWD, which began in the 1940s and are continuing in the framework of DWD's "HISTOR" project. ETMC-II endorsed investigations of the feasibility of making the DWD historical marine archive available for merger with ICOADS, in accordance with the above recommendation from WG-SP (action Mr Zöllner by mid 2007; ref.: JCOMM, 2007).

(5) In early 2008, selected archive subsets (assigned to deck 720) were provided by Mr Zöllner and blended (together with previously available subset data; total coverage: 1876-1915 (1.2M)) into ICOADS, separated by Source ID (SID) (R2.5 output period; numbers of report):

135: DWD Marine Meteorological Archive: Newly Digitized Data (1876-1902; 395K)

136: DWD Marine Meteorological Archive: HISTOR Data (1882-1899; <1K)

(6) More details about the HISTOR project were presented by Mr Zöllner at CLIMAR-III (Gdynia, Poland, May 2008, however his poster presentation was not made available for the workshop proceedings). Following up on the ACRE Workshop (Zurich, July 2008) Woodruff wrote to Mr Zöllner (3 July 2008) requesting consideration of DWD supplying more of their archived data, and while there was no written response, this issue was discussed informally by them in conjunction with a JCOMM meeting (SOT-V) in May 2009.

(7) Following Mr Zöllner's retirement in 2009, discussion has continued most recently with his replacement—Dr Gudrun Rosenhagen—at ETMC-III (JCOMM 2010). As a result, a proposal is now being developed for formal recognition of ICOADS, and potentially other centers holding global marine climatological datasets, within WMO and IOC through JCOMM. The proposed formalization would be beneficial in a number of respects, including in facilitating more open exchange of historical marine data and metadata, with the assurance that those data and metadata (in some cases rescued at considerable expense to nations) would become part of a formal and permanent international archive.

## Annex D: Undigitized US Logbook/Marine Collections

This describes the known archival location and status of US merchant (Tables D1-D2) and US Navy (Table D3) logbooks (“deck logs”) or of specialized meteorological forms.

Older data are primarily held by NARA in the National Archives I facility at Washington, DC. Post-WWII US Navy deck logs are archived at NARA II in College Park, MD. The format of US Navy deck logs was standardized by the Bureau of Navigation in 1866 and is described in the Bureau’s publication *Directions for Keeping the Ship’s Log* (1866) (summary available in Appendix II of NARS 1978). This format was largely retained throughout the 20th century.

Generally, NCDC appears to have archival oversight over meteorological forms for approximately 1903-forward [note: to be confirmed], although some of these records are still held by NARA in their East Point, GA facility (Table D4). Some of the records listed in Tables D1-D3 have been imaged by CDMP and are becoming available via EDADS.

Other logbooks or meteorological records reside in other NARA Record Groups (RG) such as of the Coast Guard (RG26; 1785-1988; <http://www.archives.gov/research/guide-fed-records/groups/026.html>) and of the Hydrographic Office (RG 37; 1754-1971; <http://www.archives.gov/research/guide-fed-records/groups/037.html>; see also Johnson and Heynen, 1971).

For example, RG37 includes (within 37.4.1 Records of the Division of Sailing Directions): “Logs and journals of the U.S. Exploring Expedition (Wilkes Expedition), 1838-42. Records of observations made by navigators on cruises (‘Daily Remark Books’), 1866-75.” US Navy Dept. (1865) for example documented requirements for navigators (paragraph 455) to submit a “remark-book” including “...a description of the instruments he may employ....”. RG45 also contains expedition logs and journals (1829-41).

Records of the Bureau of Ships (RG19; 1794-1972; <http://www.archives.gov/research/guide-fed-records/groups/019.html>) may contain some useful ship metadata (e.g. design specifications and photographs).

Records of the US Naval Observatory (RG78; <http://www.archives.gov/research/guide-fed-records/groups/078.html>) includes “Index to ‘abstract logs’ (meteorological data collected by ships), 1853-61.”

Three large log books for chronometers aboard US ships back to the 1850s are held among the rare books at the US Naval Observatory (USNO) library (<http://www.usno.navy.mil/>), but unfortunately probably do not contain any associated meteorological observations (to be investigated; Maury’s *Wind and Current Charts* available at NARA also were suggested as possibly containing meteorological and other data of interest).

Many US and possibly international whaling logbooks (Sherman et al. 1986) are held at private museums and libraries such as in the US at the Mystic Seaport Museum (Stein, 1983) and New Bedford Museum (<http://www.whalingmuseum.org/>).

Table D1. US merchant marine logbooks and related records held at NARA in RG 27, Records of the Weather Bureau (<http://www.archives.gov/research/guide-fed-records/groups/027.html>), 27.5.5 Records of the Marine Division. Periods listed in parentheses, and much of the other details listed here, were taken from a paper copy of an earlier RG27 “Location Register” obtained from NARA (Woodruff 1989). Additional records of interest may reside elsewhere within RG27 (e.g. Records of Polar Expeditions, 1881-1923; see also Finneran 1965).

<u>Period</u>	<u>Title/Description</u>	<u>Status of original records/comments</u>
1796-1861 (1842-93)	US Maury Collection	Microfilm publication M1160 (88 rolls; NARA 1986). Original records (Entry 119) occupied 526 vols.—40 ft. Data digitized by China (except as noted in Table C4) and blended into ICOADS R2.0.
1862-78 (1842-93)	Abstracts of Ships’ Logs	According to Woodruff (1989) referred to the original US Maury abstract log records (entry 119), but the dates have now changed on the NARA webpage! Those original paper records were also believed to contain about 171 additional volumes concentrated after the Civil War.* Indexes (in card and book form: Entry 120—

1886-1902	Simult. Marine Obs.	4 ft. and entry 121, 6 vols.—1 ft.) were also available.
1896-1910	Abstract Storm Logs	Entry 123—104 ft.
1895-1910	Gale/Storm Reports	Entry 124—10 ft.
1896-1910	Fog Reports	Entry 125—7 ft.
1879-93	Marine Meteorological Journals	Entry 126. Entry 128, 1,955 vols.—135 ft. An Index (entry 128—4 ft.) was also available. The collection was microfilmed by NARA (except as noted in Table B4), digitized by China, and the data have been blended into R2.5.
1887-1902	Unusual Phenomena	Entry 129—1 in.
~1873-1930	(additional records)	These appear less relevant to ICOADS (e.g. obs. summarized by ocean square) and are not itemized (additional information available on the RG27 webpage).

\* Table D5 might refer to some of these volumes. From discussion (with Woodruff in 1997) with Sharon Thibodeau, NARA, who wrote the Maury microfilm (M1160) introductory text:

*After Maury's departure due to the Civil War, Entry 119 does contain some logbooks gathered later by the Hydrographic Office (the Weather Bureau was responsible for establishing the group of logbooks that make up Entry 119, including those not directly associated with Maury). The Civil War likely constitutes a large or complete gap in the data, and the later logbooks are probably less systematic and well-organized than those gathered personally by Maury. As detailed in an index (among the holdings of the Hydrographic Office in a RG37), there were 533 original Maury volumes, of which only 355 were "transferred to the archives." But this discrepancy may be partly due to re-binding of multiple Maury volumes of similar size together at a later date, e.g. by the Weather Bureau.*

(See also WEA05 for further discussion of the US Maury Collection original and digitized records.)

Table D2. US merchant marine logbooks (and later meteorological forms), which are believed to be the responsibility of NCDC (possibly stored at NARA facilities).

<u>Period</u>	<u>Title/Description</u>	<u>Status of original records/comments</u>
1903-11	(Unknown?)	Unknown (archived at East Point/NCDC?)
1912-4?	Merchant Marine	Archived at East Point?
194?-46	World War II	Believed destroyed in 1974 by Maritime Administration, ref. Elms et al. (1997), NHC (2007)*
1945-63**	Merchant Marine	Unknown (archived at East Point/NCDC?)
1964-date†	Merchant Marine	Unknown (archived at East Point/NCDC?)

\* From NHC (2007): "There is no central repository for deck logs from merchant ships. Deck logs were traditionally considered to be the property of the ship owners to be held or disposed of according to their own recordkeeping practices. After World War II, the deck and engineering logbooks of vessels operated by the War Shipping Administration were turned over to that agency by the ship owners, and were later destroyed, by the Maritime Administration, in the 1970s on the grounds that they were voluminous, costly to house and service, and very seldom used for research."

\*\* Digitized as part of the original TDF-11 in deck 116.

† Digitized since WMO Resolution 35 (1963) in deck 128, 926, or 927. However, keying of US-recruited logbook data was virtually halted (except for a small percentage of verification records) around 1994 as part of NCDC's Marine Observations Processing System (MOPS) as a cost-savings measure to instead utilize Global Telecommunications System (GTS) data to the maximum extent.



Table D3. US Navy logbooks and specialized meteorological/aerological forms: deck logs currently through 1976 reside in RG24, Records of the Bureau of Naval Personnel (<http://www.archives.gov/research/guide-fed-records/groups/024.html>). Possibly records after 1903 are the responsibility of NCDC (similarly to the merchant records) [note: to be confirmed]. Some of the original records probably reside at the NARA East Point facility (Table D4).

<u>Period</u>	<u>Title/Description</u>	<u>Status of original records/comments</u>
1804-1976*	US Navy logbooks	NARS (1978) gives a ship inventory through 1946; also RG24 entries can be searched in "ARC," the NARA online catalog.
<i>Meteorological/aerological forms</i>		
1926-45	US Navy Monthly Aerological Record (MAR) (deck 281)	Unknown
1945-51	US Navy Marine (deck 110)	Unknown
1952-64**	US Navy Hourlies (deck 117)	East Point (Table D4) or unknown
1965-date†	(Unknown?)	Unknown

\* Deck logs are transferred to NARA after a 30-year delay (NHC 2007), thus this is a sliding date.

\*\* Thus far only a very small amount (16K reports) out of the total deck 117 (3M) reports have been blended into ICOADS, ref. <http://icoads.noaa.gov/deck117.html>.

† From about 1965 until the early 1980s [note: to be confirmed], meteorological records (or possibly logbooks) from US Navy ships were keyed at NCDC and ended up in decks 128, 926, and 927 (mixed with merchant data; hopefully identifiable by call sign/ID). At that time, due to cutbacks in Navy funding and since an assessment determined that the GTS provided adequate Navy data, NCDC halted keying Navy logbooks (approximately 300 ships per month).

Table D4. NCDC marine data accessions archived at the NARA Southeast Region (East Point, Georgia) archive facility (as of 13 September 2005; adapted from a document circulated in 2005 by Henry J. Ray, Records Officer, NCDC).

<u>Accession #</u>	<u>Series description</u>	<u>Period of record</u>
370-66-1075	Navy Marine Atlas Tabulations	1966
370-66-1371	Ships Weather Observations	1910-55*
370-66-B1371	Ships Weather Observations	1940-55
370-66-C1371	Ships Weather Observations	1940-55
370-66-D1371	Ships Weather Observations	1940-55
370-69-1840	Ships Weather Observations	1956-65
370-84-0001	Ships Weather Observations	1966-82
370-85-0004	Ocean Station Vessels Observations	1940-77
370-85-0005	Great Lakes Ships Weather Obs.	1941-82
370-88-0005	Navy Ships Weather Obs. (WBAN 11)	1974
370-88-0006	Navy Ships Weather Obs. (WBAN 11)	1975
370-88-0007	Navy Ships Weather Obs. (WBAN 11)	1976
370-88-0008	Navy Ships Weather Obs. (WBAN 11)	1977
370-88-0009	Navy Ships Weather Obs. (WBAN 11)	1978
370-88-0010	Navy Ships Weather Obs. (WBAN 11)	1979
370-88-0011	Navy Ships Weather Obs. (WBAN 11)	1980
370-88-0012	Navy Ships Weather Obs. (WBAN 11)	1981
370-88-0013	Navy Ships Weather Obs. (WBAN 11)	1982
370-88-0014	Navy Ships Weather Obs. (WBAN 11)	1983
370-88-0015	Navy Ships Weather Obs. (Form 3144)	1977
370-88-0016	Navy Ships Weather Obs. (Form 3144)	1978
370-88-0017	Navy Ships Weather Obs. (Form 3144)	1979
370-88-0018	Navy Ships Weather Obs. (Form 3144)	1980
370-88-0019	Navy Ships Weather Obs. (Form 3144)	1981
370-88-0020	Navy Ships Weather Obs. (Form 3144)	1982
370-88-0021	Navy Ships Weather Obs. (Form 3144)	1983

\* 1910-40 data permanently withdrawn to NCDC in September 2004.

Table D5. Unresolved problems and undigitized portions of the US Maury (ML) and US Marine Meteorological Journals (MMJ) Collections. [To be confirmed by NCDC that none of these issues have been resolved, including in conjunction with the German Maury digitization project.]

**(a) Overview of ML and MMJ Additional Proposed Work**

Two small supplementary data collections should be digitized as resources permit to improve the ML and MMJ: (i) two microfilm reels (40-60K records) from the past ML digitizing effort, and (ii) 31 voyages (approximately 28K records) of newly discovered data from the MMJ (see (b)). Further background on (i) follows (excerpted from: [http://icoads.noaa.gov/doc/other/transpec/maury/maury\\_transpec](http://icoads.noaa.gov/doc/other/transpec/maury/maury_transpec)):

'[1] Reels keyed in the Collection

Reels 1-2 and 45 were missing from the digital data obtained from the CD-ROM. This was explained by CD-ROM documentation "about.txt" (excerpted as follows) except that it erroneously refers to reel44 (references should be to reel45):

"There were eighty-eight reels of microfilmed records in the collection. Reels One, Two, and Forty-four do not appear on the CD-ROM. Reel One is simply an inventory, and we were unable to produce clear paper copies from Reel Two. Reel Forty-four, keyed in a different format, was used in the pilot digitization project to help finalize the formats that were adopted for the remainder of the collection. Reel Forty-four will later be converted to a common format."

At this writing, NCDC has been unable to locate the details of the "pilot" format used for reel45. Moreover, notes indicated that only about half the data from the reel were keyed, owing to some paper copies being lost enroute to China. These data will need to be re-digitized under a future project.'

**(b) MMJ Records Not Microfilmed (information received by Joe Elms from NARA c. 2003)**

Several Marine Meteorological Journals were inadvertently filed with the "Maury Logs" (i.e. the US Maury Collection). The following Journals have not been microfilmed, and are filed in boxes 58 to 64 in the "Maury Logs" series:

<i>Volume "Maury Logs"</i>		<i>Name of Ship</i>	<i>Dates</i>
<i>Number</i>	<i>Number</i>		
181	319	<i>William Frederick</i>	1888-1889
322	339	<i>Sarmatian</i>	1879
337	329	<i>Conqueror</i>	1879
1023	308	<i>David Brown</i>	1883-1884
1274	311	<i>W.C. Sibley</i>	1884
1388	313	<i>San Pablo</i>	1885
1834	337	<i>Portland Lloyds</i>	1886
2077	317	<i>Hudson</i>	1885
2078	327	<i>Hudson</i>	1885
2081	334	<i>Red Cross</i>	1885
2083	332	<i>Coryphene</i>	1885
2084	315	<i>Coryphene</i>	1885
2085	344	<i>Coryphene</i>	1886
2086	333	<i>John D. Brewer</i>	1885
2087	343	<i>John D. Brewer</i>	1885
2088	322	<i>Ada Peard</i>	1885
2141	326	<i>C.F. Sargent</i>	1885
2595	309	<i>Thessalus</i>	1885-1886
2586	341	<i>Duchess of Albany</i>	1886
2626	330	<i>Imperial</i>	1885
2642	310	<i>Peterborough</i>	1886
2697	323	<i>Vincenze Accame</i>	1886-1887
3088	338	<i>Atlantic</i>	1886
3235	325	<i>Glide</i>	1887-1888
3719	342	<i>Oceanic</i>	1887
3793	320	<i>Savanna</i>	1888
3802	324	<i>L. Schipp</i>	1889

3805	312	<i>Robert Dixon</i>	1889-1890
3828	331	<i>George V. Jordan</i>	1887-1888
3832	335	<i>Jose Olaverri</i>	1888
3834	336	<i>Freeman</i>	1888

## Annex E: International Simultaneous Ship Observations (~1874-1947; Published and Original Forms)

### 1. *Bulletin of International Simultaneous Observations 1875-89 (ref. sec. 2.8.1 in the main text)*

Forty-five volumes published by the Weather Bureau covering 1875-87 have been located at NCDC and at the NOAA Central Library; however, semi-annual publications for 1888-89 (Moore 1894, NOAA 1978) have not yet been located. Note on possible duplicate observations between volumes: Sometimes bound volumes contain previously printed months (e.g. volumes 1875 April-June and 1875 May-June), which contain the same observations. Reprinted months will have to be investigated further as to why the same month would have been bound and published twice. Upon preliminary review it appears that observations located in duplicate months are duplicates, but all will have to be verified as duplicate or unique.

Table E1. Timeline listing noteworthy changes in marine data characteristics, of the Weather Bureau *Bulletin of International Simultaneous Observations*.

<u>Date</u>	<u>Change in marine data characteristics</u>
01/01/1875	· Bulletin started, but NO marine data – only terrestrial
04/24/1875	· Marine Series begins
05/31/1876	· First Naval Series (no data) – data is now split between US merchant and US Navy ships
01/01/1877	· First column of “Stations and Vessels” in the Naval Series, but no data
01/04/1877	· Naval Series with data
01/13/1877	· Variety of Marine Series with data – merchant ships now categorized by shipping lines.
05/01/1879	· Stopped recording “Attached Thermometer” data
03/12/1880	· Ceased having an “Attached Thermometer” column
07/01/1880	· International merchant and naval ships included, divided by nationality, with merchant ships sub-divided by shipping lines · Only shows 7:35am Washington Mean Time on the cover · No more ‘Notes’ · All ‘Corrections’ are now noted in the Monthly Summary (00/dd/yyyy) volumes: “The following symbols and abbreviations are common to all the series, viz: †, aneroid; *, instrumental error and the reduction to sea-level whenever they could be ascertained by means of reliable comparisons made when the vessel was at or near land-stations”. “The following symbols and abbreviations are common to all the series, viz: †, aneroid; *, instrumental error and the reduction to sea-level whenever they could be ascertained by means of reliable comparisons made when the vessel was at or near land-stations”
01/01/1880	· The time for International Meteorological Observations is now 7am, Washington Time. Unless otherwise noted. “On and after January 1st, 1881, the times for Simultaneous International Meteorological Observations will be 35 minutes earlier than the above (7:35am WMT); meanwhile any such early observations will be published with a §.”
02/01/1883	· Use of ‘Districts’ to categorize vessel locations
06/30/1884	· Last Daily Marine Observation

### 2. *Records of Simultaneous Meteorological Observations on Ships 1886-1902 (NC 3 Entry #123; 200 boxes) 1886-1902 (ref. sec. 2.8.2)*

- Forms have been imaged and will be loaded to EDADS.

*3. Records of International Simultaneous Ship and Land Observations, 1874-92 (NC Entry #69; 16 Oversize volumes and possibly 47 additional boxes) (ref. sec. 2.8.3)*

- This one is not very clear and needs more investigation. Books are rumored to be in very bad shape and have not been set for imaging/digitization. A check for unique records not included in #1 or #2 will have to be investigated.

*4. GMN Monthly and Daily Marine Forms (1910-47) (ref. sec. 2.8.4)*

- Total of 956 boxes containing approximately 500K pages.
- Form types are as follows: Form No. 1201-M, Form No. 1210A-Marine, W.B. Form No. 42, N.H.O. 407, N.H.O. 123, Form 121, Form 121A, Form Model No. 10, Form 911, Form 138, N. Nav.43, N. Aer. 443 (a, b, c and d), N. Aer. 473 (a, b, d and pp), FormNAVAER-443A2, Form N. Aer 472, Form D-201, Form 50, Form 43 and miscellaneous. There are 14 form types for the 8½" x 3¼" booklets: Form No. 1201-Marine-15 days, No. 1201-Marine-31 days, No. 1201 O.M.-15 days, No. 1201 O.M.-31 days, No. 1 O.M.-15 days, No. 1 O.M.-31 days, 105-15 days, 105-31 days, 105-12-'94, 105-11-'95, 105-5-'95, 105-6-'96, 105-33, 105-77.
- Meteorological elements vary per form type and are as follows: vessel name, type of ship (steam or motor), voyage from, destination, location (port name or lat/lon if out to sea), octant of globe, nationality observational time (GMT/LST), barometer type, ship's course, ships speed, average ship's speed during last 3 hours (knots), wind direction, wind force (Beaufort scale), barometer (corrected or uncorrected) (inches, millibars, millimeters), attached thermometer, dry bulb, wet bulb and sea water temperatures (Fahrenheit, Centigrade, Kelvin, Reaumur), present weather, past weather, visibility (miles or code), total cloud amount (tenths or code), low cloud type, low cloud amount, middle cloud type, upper cloud type, percentage of clouds, barometric tendency, barometer too high or too low, sea direction, sea state (Douglas scale), swell direction, swell (Douglas scale).

**Annex F: Lightship Observational Forms 1937-82  
From Woods Hole Oceanographic Institute (WHOI)  
(Information about earlier holdings at NARA back to 1916 to be added)**

- WHOI forms have been imaged and loaded to EDADS.
- Forms types are as follows: WB Form 1210F, WB Form 615-5, ESSA Form 72-1, NOAA Form 72-1, NOAA Form 72-1A, WB Form 1083, WB Form 1082, Form 1083, WB Form 610-7, WB Form 610.6-1, WB Form 1034, WB Form 630-8, Form No. 1130-AER, SC Form 444, NOAA Form 72-5A, ESSA Form 72-5, DATAC-ER 1
- Meteorological elements vary per station and are as follows: station/lightship name, octant/quadrant, latitude/longitude, observational time (GMT/LST), wind direction, wind velocity (mph, knots, beaufort scale), wind gusts, estimated wind speed and gusts, sea-level pressure (millibars and inches), station pressure (millibars and inches), altimeter, 3 hour pressure characteristic, 3 hour pressure change, 3 hour pressure tendency exceeding 9.9 millibars, dry bulb, wet bulb and dew point temperatures (Fahrenheit and Centigrade), relative humidity, sea-water temperature (Fahrenheit and Centigrade), wave direction (1st and 2nd wave group), wave period (1st and 2nd wave group, wave height (1st and 2nd wave group), state of sea (plain language remarks), swell direction, swell (low, moderate, heavy etc..) visibility (statute miles, nautical miles, yards, feet, kilometers), present weather, past weather, max and min thermometer at observation, time of precipitation or thunderstorm, total precipitation past 6 hours, total cloud amount, low/middle/high cloud type, height of lowest cloud, amount of lowest cloud, ceiling.

Table F1. The names of the 14 lightships that were keyed, and their approximate period(s) of record (note: which may include missing periods, in the event no data were available).

<u>Lightship Name</u>	<u>Period(s) of record</u>
<i>Ambrose</i>	1937-74
<i>Barnegat</i>	1947-70
<i>Boston</i>	1958-75
<i>Buzzards Bay</i>	1958-80
<i>Chesapeake</i>	1947-79
<i>Delaware</i>	1961-70
<i>Diamond Shoals</i>	1947-74
<i>Five Fathoms</i>	1957-72
<i>Frying Pan Shoals</i>	1936-79
<i>Georges Shoal AFS</i>	1956-60
<i>Nantucket</i>	1916-18 and 1947-82
<i>Pollock Rip</i>	1947-69
<i>Portland</i>	1956-66
<i>Savannah</i>	1954-64

## Annex G: CDM Task, EDADS Library, and ICOADS Cross References

Table G1. Correspondence between original archive information (NARA RG 27 Entry information from Woodruff 1989), CDM task dataset names, Task Nos., EDADS Libraries, and ICOADS information. The pathway to the EDADS location of each imaged collection is given starting from one (or two) of the three top-level libraries: Surface Daily Observational Forms (S. Daily O.F.), Surface Monthly Observational Forms (S. Monthly O.F.), and Documentation. For Period of Record, "resultant" refers to the processed data made available to the public in ICOADS. [Note: Later perhaps there might be another Table G2 for international projects e.g. ACRE-related data rescue tasks that aren't directly related to CDM, providing similar information including the ICOADS assignment numbers.]

<u>Dataset name</u>	<u>Original archive</u>	<u>Original archive location information</u>	<u>Period of record</u>	<u>CDMP Task Nos.</u>	<u>EDADS Pathway</u>	<u>ICOADS deck [SID]</u>
Japanese Whaling Ships	Japan?	Photocopies provided by M.I.T.	1946-84 (resultant)	#45 (old system ?)	(N/A)	761 (see also 187) [115; see also 116]
WMO Pub. 47 metadata	WMO	publication (international libraries)	1955-98	L-19 L-10?	Documentation/ Reference Manuals/ Materials	(N/A)
US Maury Collection	NARA	RG 27; Microfilm publication M1160; Entry 119 (526 vols.--40 ft.) contained the original paper records	1784-1863 (resultant)	(N/A, digitization by China)	S. Daily O.F./ Maury Journals (U.S.)	701 [69]
KNMI Logbooks	??	??	1826-55	(TBD)	S. Daily O.F./ Dutch Logbooks	(TBD)
German Maury Collection	DWD	??	1845-67	05-07	S. Daily O.F./ Maury Journals (German)	(TBD)
US Marine Met. Journals	NARA	RG 27 Entry 127 (1,955 vols.--		(N/A, digitization by	S. Daily O.F./ U.S. Marine Meteorological	704 [125]

		135 ft.)		China)	Journals	
World War II RN Ship's Logs	UK National Archives (TNA)	??	1938-1947	L-23	S. Daily O.F./ Royal Navy WWII Logbooks	245 [126]
US Lightship Data	NARA	RG ? Entry ?	??	??	S. Daily O.F./ Lightship Observations/ NARA Lightship Daily Obs. <i>and</i> NARA Monthly Obs.	(TBD)
US Lightship Data	WHOI	??	(see Table F1)	04-35	S. Daily O.F./ Lightship Observations/ Lightship Daily Obs. <i>and</i> Lightship Monthly Obs.	(TBD)
English East India Co.	British Library	India Office Records	1789-1834	L-23	S. Daily O.F./ East India Company Logbooks	(TBD)
UK Hull Merchant Logbook Collection	Hull City Library	Received as digital images	1798-1835	??	(TBD??)	(TBD)
UK Hull Whaling Logbook Collection	Hull City Library	3 rolls of microfilm	1812-1861	??	(TBD??)	(TBD)
US Fish Commission	Smithsonian Institution	??	1877-1948	L-49	(TBD??)	(TBD)
US Fish Commission	NARA	RG 22	??	(TBD)		
<i>Bulletin of International Simultaneous Observations</i>	NOAA Central Library and NCDC	NOAA Central Library and NCDC (bound volumes)	1875-89	L-54	Daily/ Bulletin of Intl. Simultaneous Obs.	(TBD)
Records of Simultaneous Met. Obs. on Ships	NARA	RG 27 Entry 123 (104 ft.)	1886-1902	(TBD)	(TBD)	(TBD)
Record of International Simultaneous Ship and Land Obs.	NARA	RG 27? Entry 69?	1874-92	(TBD)	(TBD)	(TBD)
Greenwich Mean Noon Obs.	NCDC	Original paper forms	1910-47	L-17	S. Daily O.F./ <i>and</i> S. Monthly O.F./ Pre-1947 Greenwich Mean Noon Marine Obs.	(TBD)